XYLARIA ANTIQUA SP. NOV. (ASCOMYCOTA: XYLARIACEAE) IN DOMINICAN AMBER

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ABSTRACT

Xylaria antiqua sp. nov. is described from Tertiary Dominican amber. Characters of the stroma, perithecia, ascospores and a white bloom of conidiogenous cells bearing conidiophores and conidia place the fossil in the Xylariaceae and genus *Xylaria*. The preservation of *X. antiqua* is excellent and the morphological characters of the hyphae and spores appear unaltered. This is the first record of a fossil fruiting body of the family Xylariaceae and shows that the basic characteristics of this group were already established some 20–30 million years ago.

RESUMEN

Se describe **Xylaria antiqua** sp. nov. del ámbar dominicano del Terciario. Caracteres del estroma, peritecios, ascosporas y un grupo blanco de células conidiógenas portadoras de conidióforos y conidios colocan al fósil en las Xylariaceae y género *Xylaria*. La preservación de *X. antiqua* es excelente y los caracteres morfológicos de las al hifas y esporas parecen sin alterar. Esta es la primera cita de un cuerpo fructífero fósil de la familia Xylariaceae y muestra que las características básicas de este grupo ya estaban establecidas hace unos 20–30 millones de años.

INTRODUCTION

Members of the genus *Xylaria* are very curious fungi in that their fruiting bodies often resemble decaying plant remains protruding from the ground. One of the more observed species, *X. polymorpha*, has dark brown to black club-shaped fruiting bodies that have been aptly named "Dead-Man's Fingers." Other species, such as *X. hypoxylon*, have antler-like, often arching fruiting bodies that have earned it the common name of "Candle-Snuff Fungus." These fungi are common pathogens, saprobes and endophytes that frequently fruit on dead wood and other plant substrates. They occur in many parts of the world today and are especially interesting since both asexual and sexual stages often occur on the same stroma, albeit usually not at the same time; conidia on mature stromata are remains of the earlier asexual phase.

While examining inclusions in amber from the Dominican Republic, a specimen of *Xylaria* was discovered. This fossil belongs to the group of *Xylaria* that are characterized by flattened thick branches rather than unbranched clubs. This specimen is described and represents the first record of a fossil fruiting body of the family Xylariaceae, to my knowledge, and shows that the basic characteristics of this group were already established some 20–30 million years ago.

MATERIALS AND METHODS

The description presented here is based on one complete and well-preserved stroma in Dominican amber. The specimen was obtained from mines in the Cordillera Septentrional of the Dominican Republic. Dating of Dominican amber is still controversial with the latest proposed age of 20–15 mya based on foraminifera (Iturralde-Vinent & MacPhee 1996) and the earliest as 45–30 mya based on coccoliths (Cêpek in Schlee 1990). Dominican amber was produced by the leguminous tree, *Hymenaea protera* Poinar, and a re-construction of the Dominican amber forest based on amber fossils indicated that the environment was similar to that of a present day tropical moist forest (Poinar & Poinar 1999). The amber piece was repolished to view the conidia and perithecia on the branches of the stroma. Observations and drawings were made with a Nikon SMZ-10 stereoscopic microscope.

DESCRIPTION

Characters of the stroma, perithecia, ascospores and a white bloom of conidiogenous cells bearing conidiophores and conidia places the fossil in the Xylariaceae and genus *Xylaria* (Rogers 1979, 1983, 1984a, 1984b).

Phylum: Ascomycota
Order: Xylariales
Family: Xylariaceae
Xylaria Hill ex Schrank

Xylaria antiqua Poinar, sp. nov. (**Figs. 1–7**), MycoBank no.: **MB 808649.** TYPE: DOMINICAN REPUBLIC: amber mines in the northern mountain ranges (Cordillera Septentrional) of the Dominican Republic, Jul 1994, *unknown amber miner s.n.* (HOLOTYPE: accession # AF-9-12, deposited in the Poinar amber collection, Oregon State University).

Stroma clavate, flattened, broad, many branched from lower third to near apex, with obtuse to blunt apices; length of entire specimen (substrate base + stoma), 15 mm; length of perithecium-bearing stroma, 8 mm, greatest width stroma, 7 mm; stipe short and broad, length stipe, 2 mm; width stipe,1.5 mm; most perithecia embedded in stroma with projecting ostioles; some perithecial elevations exposed on surface of stroma; height of perithecia, 116–130 µm; asci not observed; ejected ascospores single-celled, smooth walled, light brown, ranging from bean-shaped to ellipsoidal, 15–18 µm × 7–11 µm; germ slit faint, longitudinal, slightly curved.

Asexual (anamorph) state occurring as cream-colored, conidiogenous palisades over apices of stromal branches; conidia hyaline, smooth, ovate to elongate elliptical, 3–4 µm × 1–2 µm, borne singly or in pairs on persistent conidiophores covering stroma.

Etymology.—From the Latin "*antiquus*" = old.

Diagnosis.—The broad, flattened, branched, robust stroma with abrupt apices and roughened surface and the short, broad stipe, small conidia, ascospores and age appear to separate *X. antiqua* from extant members of the genus, despite the fact that only one stroma was available and it is unavailable for dissection. The fossil exhibits some similarities with *Xylaria cornu-damae* (Schwein.) Berk. and *X. digitata* (L.) Grev. (Rogers 1984a) from the Americas; however, both of these species have rounded or pointed apices rather than blunt tipped ones as in *X. antiqua*.

The shape of the ascospore and longitudinal germ slit of *X. antiqua* is similar to that of *X. allantoidea* (Berk.) Fr. (Rogers 1984b; p. 918, Fig. 25), a wide ranging species found throughout the Americas and Africa and *X. grandis* Peck (Rogers & Callan 1986; p. 396, Fig. 20) from North America. The germ slit in all of these is depicted under the light microscope by a faint white, somewhat blurred line extending along the side of the spore. However, both of these extant species have unbranched stromata. In their key to the *Xylaria* of North America (Rogers & Callen 1986), which is mainly based on characters of the ascospores, *X. antiqua* aligns with *X. mali* Fromme; however, that species has rounded fertile apices.

DISCUSSION

Xylariaceous fungi are primarily parasites and saprophytes of angiosperms and occur on limbs, standing tree trunks or logs. Most xylariaceous fungi occur in lowland forests, subtropics and cloud forests (Rogers 1979). Some species of *Xylaria* appear to be host-specific (Laessøe & Lodge 1994). These authors discuss two species of *Xylaria* (*X. meliacarum* Laessøe and *X. guareae* Laessøe & Lodge) that occur only on trees in the family Meliaceae, including on the leaves of *Trichilia* species in Puerto Rico. This angiosperm family was represented in the original Dominican amber forest by at least 3 species of *Trichilia* and one species of *Swietenia* (Meliaceae) (Chambers et al. 2011; Chambers & Poinar 2012a, 2012b). However, a few *Xylaria* species (*X. luxurians* (Rehm) C.G. Lloyd, *X. ianthino-velutina* (Mont.) Fr.) occur on leaves and pods of legumes (Laessøe & Lodge 1994; Dennis 1956), which suggests that the Dominican amber legume tree, *Hymenaea protera*, also could have served as host. It is likely that *X. antiqua* was growing on a dead branch of *H. protera* and after becoming dislodged, possibly by some animal, fell into a pool of resin that had collected on one of the lower branches.

The upright stromata of *Xylaria* species are considered to raise the perithecia above the substrate for more

Fig. 1. Entire specimen of *Xylaria antiqua* in Dominican amber. Bar = 2.4 mm.

efficient ejection and dispersal of the ascospores (Rogers 1979). Rogers (1979) considered the small, conidia to represent relictual spermatia and questioned if they were functional. It is now known that conidia of some *Xylaria* species are propagules (for example, see Rogers et al. 2008). On *X. antiqua*, many of the terminal branches of the stroma appear to be immature, bearing conidia that are the remains of the earlier asexual state.

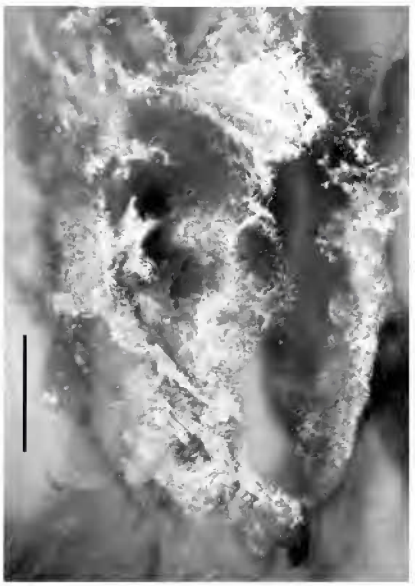

Fig. 2. Mycelial surface of substrate portion of *Xylaria antiqua* in Dominican amber. Bar = 510 µm.

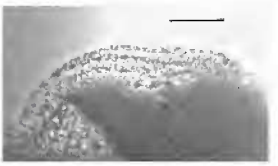

Fig. 3. Layers of conidiophores with conidia on stroma of *Xylaria antiqua* in Dominican amber. Bar = 120 µm.

Fig. 4. Single layer of conidiophores with conidia on stroma of *Xylaria antiqua* in Dominican amber. Bar = 40 µm.

Fig. 5. Ostioles of perithecia protruding from stroma of *Xylaria antiqua* in Dominican amber. Bar = 50 µm.

Fig. 6. Perithecium on stroma of *Xylaria antiqua* in Dominican amber. Released ascospore is on right. Bar = 40 µm.

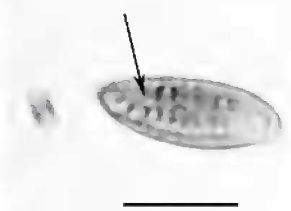

Fig. 7. Ellipsoidal ascospore of *Xylaria antiqua* with faint, longitudinal, germ slit (arrow) in Dominican amber. Bar = 11 µm.

The preservation of *X. antiqua* is excellent and the morphological characters of the hyphae and spores appear unaltered. The pristine condition of amber fossils is thought to be the result of fixation of the tissues from chemicals in the original resin. In amber embedded arthropods, there may be some collapsing of the appendages due to dehydration, which is also an important stage in the preservation process. However, it is rare to find any sign of dehydration or collapsing of the tissues of fungi in amber. Even the pileus of the Early Cretaceous Myanmar amber agaric, *Palaeoagaracites antiquus* Poinar & Buckley (2000) that was partly decomposed by a mycoparasite showed no signs of preservation distortion, nor did the much older spores retained on the

phialides of the Early Cretaceous Myanmar amber Hypocreales, *Paleoophiocordyceps coccophagus* Sung, Poinar, & Spatafora (2008).

While this is the first fossil record of a fruiting body of a member of the Xylariaceae, as far as I am aware, the group as a whole has a more extensive history. Bharati et al. (2003) reported xylariaceous, single furrowed amerospores similar to those found in some *Hypoxylonites* and *Spirotremesporites* from Late Cretaceous and Tertiary sediments of northeastern India.

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